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ABSTRACT

It was hypothesized that a study skills package, based on active information strategies and incorporating test taking techniques, could be very beneficial to students enrolled in one of the four technical specialties courses in the Air Force Instructional System, a computer managed instructional system. The study skills materials consisted of self-study modules in the areas of reading comprehension, memorization, concentration management, and test taking skills. Evaluation of the program results indicated that consistent student training time reductions and performance gains were obtained using the study skills materials for students identified as deficient in certain basic skill areas. Results also indicated that including course instructors in the initial design and implementation of the project greatly facilitated the transition of the materials from a research program to ongoing, permanent aspects of the course. (MKM)

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Study Skills Remediation:

Beneficial Effects of Individualized Skill Training

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Numerous researchers have noted that one of the most serious and persistent problems which students experience, regardless of ability level, is ineffective study skills (Briggs, Tosi, & Morley, 1971; Gadzella, Goldston & Zimmerman, 1977; Groveman, Richards, & Caple, 1977; Larkin & Reif, 1976; McReynolds & Church, 1973; Poore & Pappas, Note 1). It is reasonable to expect, moreover, that these study skill inadequacies will be compounded in the novel environment of computer-managed instruction (CMI) where students are expected to take increased responsibility for their own learning. Even for those students who possess effective study skills, CMI will require them to transition their traditional learning behaviors to those active information processing strategies and skills required for self-directed learning.

Dansereau and his associates have posited that there are many components of effective study skills behaviors (Dansereau, Actkinson, Long, & McDonald, 1974; Dansereau, Long, McDonald, & Actkinson, 1975; Dansereau, Long, McDonald, Actkinson, Ellis, Collins, Williams, & Evans, 1975; Dansereau, Long, McDonald, Actkinson, Collins, Evans, Ellis, & Williams, 1975; Dansereau, Collins, McDonald, Diekhoff, Garland, Holley, Evans, Irons, & Long, 1977; Dansereau, 1979). Most of these components are particularly relevant to a student's successful adaptation to CMI requirements. For example, Dansereau has identified in his learning strategy materials such components as creating a good mood for learning, self-coaching skills, concentration management techniques, general study skills and strategies, and test-taking skills. In a recent discussion of the results of this training, Dansereau (1979) reports dramatic improvement of student skills. The need still exists, however, to demonstrate the effectiveness of such training in terms of performance gains in a CMI course.

Weinstein (Note 2, Note 3, Note 4) focused on improving student skills for remembering and processing information. She has developed materials and procedures for teaching students the use of various mnemonic devices, sentence and imaginal elaboration techniques, analogies, paraphrasing, and techniques for drawing implications and creating relationships. The essence of these materials is having the learner become actively involved with the information to be learned, such that the material becomes personally meaningful. Evaluations of these materials have shown them to be effective but, as with Dansereau's materials, there is still a need to demonstrate their effectiveness in terms of improving student performance in a CMI environment.

The training materials of these two researchers are quite similar in that the philosophy upon which both of them are based derives from general learning theory and a growing body of empirical research within the fields of cognitive psychology and information processing theory. The focus of this research is on the active role of the learner in the learning process. A major proponent of this framework is Wittrock (1974) and Wittrock and Lumsdaine (1977) who have advanced a generative model of learning. A basic premise of this model is that learners generate their own meanings and perceptions about materials to be learned and these meanings and perceptions are consistent with their prior learning. In a recent study by Doctorow, Wittrock,

and Marks (1978), the success of teaching active information processing strategies was demonstrated. The results of this study indicated that, as predicted, the combination of inserted paragraph headings and instructions to generate sentences about story paragraphs approximately doubled reading comprehension and recall as compared to a control condition.

Additional evidence for the effectiveness of learning strategies which actively involve students in the material, or assist students in making the information to be learned more meaningful, is provided by an increasing number of empirical studies. These studies embody a wide variety of active learning strategies, including

1. visual or verbal elaboration strategies (e.g., Andre & Sola, 1976; Delaney, 1978; Hunter, 1977; Lyon, 1977; Rasco, Tennyson, & Boutwell, 1975; Snowman & Cunningham, 1975);

2. generative underlining or sentence generation strategies (e.g., Bobrow & Bower, 1969; Frase & Schwartz, 1975; Rickards & August, 1975);

3. serial rehearsal training strategies (e.g., McCauley, Kellas, Dugas, & DeVellis, 1976);

4. meaningful semantic processing strategies (e.g., Anderson, Goldberg, & Hidde, 1971; Bellezza, Cheesman, & Reddy, 1977; Mistler-Lachman, 1974; Postman & Kruesi, 1977);

5. note taking or reorganization strategies (e.g., Arkes, Schumacher, & Gardner, 1976; Carter & VanMatre, 1975; Fisher & Harris, 1973; Shimmerlik & Nolan, 1976);

6. problem-solving strategies (e.g., Olshavsky, 1977); and

7. self-reference strategies (e.g., Meichenbaum, 1975; Rogers, 1977).

Good literature reviews in this area are provided by Bernstein (1973), Faw and Waller (1976), and Shimmerlik (1978).

Another area of concern in study skills training, as noted by Dansereau (1979), is the learners' test-taking skills. This area is particularly relevant to a CMI environment where the number of tests which students are required to pass is substantially greater than that required in conventional classrooms. A prototype Test-Wiseness program, described and evaluated by Woodley (Note 5), provides students information and practice in applying specific test-taking strategies. Preliminary pre-posttest evaluation of this program, indicated that, as measured by a test-wiseness scale, students' test-taking skills did improve (Note 5). Gross (1977) reports similar results in a study where

eighth grade students, who were taught three test-wiseness behaviors, improved both their skills in this area and their scores on standardized achievement tests, as compared to students who had not learned these skills.

In the present study, it was hypothesized that a study skills package, based on active information strategies and incorporating test taking tecniques, could be very beneficial to students enrolled in an operational CMI system. The CMI system around which this study was designed is the Air Force Advanced Instructional System (AIS). Within the AIS, students in one of four technical training specialities learn their respective course materials via individually paced, computer-managed instruction. That is, this study was implemented in an applied, as opposed to basic, research setting and was, accordingly, designed to provide methods and strategies for improving Air Force technical training, not for advancing educational theory. Although many researchers believe that the distinction between basic and applied research is becoming increasingly blurred (e.g. Gehlbeck, 1979, Glaser, 1979; Glass, 1979), Kerlinger (1977) has made a very convincing argument for maintaining the distinction between these two areas. Essentially, Kerlinger has proposed that the primary purpose of basic research is to develop theory--to understand and explain phenomena--while the major goal of applied research is to achieve practical objectives and find solutions to practical problems. The applied researcher, then uses the theoretical explanations and understandings derived from basic research in making practical decisions about what will work best in a particular applied situation. The relevance of this issue to the present study is simply that the effectiveness of a package of study skill materials was evaluated on the basis of utilitarian and cost-benefit considerations. That is, did the use of these materials result in improved instructional procedures or outcomes as measured by gains in student performance, retention, etc.?

The goals of the present study, then, were to evaluate the practical benefits of the Study Skill Modules developed by Dobrovolny, McCombs, & Judd (Note 6). These materials are based in part on the work of Dansereau, Weinstein, and Woodley and, as such, consist of a set of self-study packages for teaching students active study strategies and skills in the area of reading comprehension, memorization, concentration management, and test taking. The present study was, therefore, designed to evaluate the effectiveness of these materials for improving students' completion times and criterion test scores in the AIS.

Method

General approach. As an applied research study, the methodological focus was mainly on practical engineering concerns, rather than scientific concerns. That is, considerable effort was spent on (a) designing an effective strategy for getting the materials to the appropriate trainees and (b) identifying appropriate procedures and criteria for evaluating whether these materials actually improved the course performance of these trainees.

The resulting implementation and evaluation methodology was divided into two phases. During the first phase, the authors were responsible for the study skill materials and, thus, had some control over how they were implemented. During this phase of the evaluation, instructors in the Inventory Management (IM), Weapons Mechanic (WM), and Precision Measuring Equipment (PME) courses were given the opportunity to voluntarily participate in the study skills remediation program. Those who did volunteer, attended a five hour training program which explained (a) the purpose and content of the study skill materials, and (b) general procedures for identifying and diagnosing study skill deficiencies. (Dobrovolny, McCombs, & Judd, Note 6). Upon completion of this training, instructors were given the latitude to assign students, whom they diagnosed as study skill deficient, to any of the remedial materials they deemed appropriate, at any point in the course. Pre and post treatment evaluation data were accordingly available for those students assigned the materials by their instructors.

Prior to the second phase of the evaluation, the study skill materials were transitioned into the schools and the authors were in a position to merely observe their effects. At this time, management personnel in the WM and PME schools decided that all WM and PME students who scored below a course specific cutoff on selected preassessment reading tests would be assigned these materials before beginning their military training. Thus, upon having the computer evaluate their preassessment test forms, students who met the remediation criteria were immediately assigned the total study skills package. Those students who did not meet the criteria (scored higher on various reading tests) were given the first lesson assignment in the course. These phase II procedures resulted in a situation in which it was not possible to (a) collect pre/post evaluation data or (b) obtain a control group. Additionally, the Phase I instructor training program, which explained the purpose and content of the study skill materials, and the general procedures for identifying and diagnosing study skill deficiencies, was deemed unnecessary by course management as (a) the computer was now responsible for diagnosing student study skill deficiencies and (b) many instructors who had participated in the initial training program were to also participate in the Phase II evaluation.

Subjects. For the first phase of the evaluation, subjects were male and female Air Force trainees enrolled in the IM, or WM courses between July and September 1978. During this time period, complete evaluation data for trainees assigned the study skills materials were restricted to five trainees in the IM course and six trainees in the WM course. These figures do not, however, reflect a completely accurate picture of the extent to which the instructors assigned these materials. It was learned from the instructors and data clerks in these courses that numerous instructors had obtained materials for assignment to students, but had not identified the students to the AIS data base. A conservative estimte of the additional students is 10 in the IM course and 25 in the WM course.

For the second phase of the evaluation, subjects were male and female Air Force trainees enrolled in the WM course from February through July 1979, and in the PME course from November 1978 through February 1980.

Measures. During the first phase of the evaluation, trainees scores on the Study Skills Questionnaire (SSQUES; McCombs & Dobrovolny, Note 8), administered to all trainees at the beginning of all AIS courses, and measures of performance in the course (lesson and block scores and times) were used by instructors in selecting students for study skills remediation. During the second phase of the evaluation, study skill materials were assigned by computer-based individualization rules which utilized data from selected measures in the preassessment battery of each course. In the WM course, these measures were course specific reading comprehension and technical reading vocabulary measures. In the PME course, reading comprehension scores from the California Achievement Test were used to determine which trainees were to be assigned the study skills remediation.

The criterion variables of interest were times-to-complete and criterion tests scores on selected blocks and lessons. That is, students were evaluated on (a) the length of time they took to complete each lesson within a block, (b) the time they took to complete each block within the course, (c) the criterion test scores on each lesson, and (d) criterion test scores on each block. Evaluation data for lessons within a block or for an entire block were eliminated when the data were found to be unreliable due to computer down time or substantial curriculum changes during the evaluation time period.

Elimination or disenrollment figures were also used as criterion variables in the second evaluation as retaining students translates into substantial monetary savings for the Air Force.

Study skill materials. The Study Skill Modules developed and described by Dobrovolny, McCombs, and Judd (Note 6) were the focus of this study. These materials use a variety of active information processing strategies and concepts and behavioral self-control techniques for teaching students specific skills in reading comprehension, memorization, test taking, and concentration management. The materials are divided into four modules, corresponding to the four subject areas, and are written in a narrative style which employs frequent use of cartoons and graphics.

Results

Phase I evaluation. Given the small number of students per course with sufficient performance data for analysis, individual students' pre/post block time and score data are reported in Table 1. These data are shown as standardized scores to allow comparisons of performance changes across courses with variable block lengths and block test difficulty levels. For each block, score and time means and standard deviations were computed for all students in each course during the evaluation period. The appropriate mean was subtracted from each student's (time or score) performance value for each block. The resultant value was then divided by the appropriate standard deviation. This procedure yielded an index for each student for each block which represented his or her performance relative to all other students. Finally, for each student, an average standard score was computed for both the student's pretreatment period and for the post-treatment period. It is these pre- and post-treatment scores which are reported in Table 1. Table 1 also indicates, by student, the particular Study Skills Module(s) which are assigned and reports the overall average pre/post standard scores per course.

As can be seen in Table 1, all five IM students improved their block times (a reduction in the standard score values) from pre to post study skills remediation, from an average of 2.86 standard deviations above the mean for pretreatment, to an average of 1.30 standard deviations above the mean for post-treatment. Similarly, four of the six WM students improved their block times from pre to post study skills remediation, while two of the six students demonstrated some increase in block times. The average pre/post block time scores were 2.21 and 1.24, respectively, indicating an overall improvement in WM student block times of one standard deviation. It is also of interest that the

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Insert Table 1 about here

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WM students who were assigned all four Study Skills Modules all improved their block times, while the WM students who were assigned only the Reading Comprehension Module showed some increase in block times. It may be that increasing students' reading comprehension skills through the use of active information processing strategies increases their productive on-task time for WM course

tasks, a possibility supported by the block score results shown on the bottom half of Table 1. The overall improvement in student block times, however, across the IM and WM courses indicates that study skills remediation led to an improvement of 2.54 to 1.27.

Pre/post block score changes for IM course students indicate that all five students improved (an increase in standard scores) their block scores following study skills remediation. The average improvement was from -1.45 to -.34. All five WM students with pre/post block scores also improved their performance following study skills remediation, with the average change being from -.93 to .41. Thus, an improvement in block scores was found, even for those WM students who were assigned only the Reading Comprehension Module. It is interesting to note that even though two of the IM students were assigned only one Study Skills Module, they made both time and score improvements following remediation. This may have been due to an appropriate instructor match of materials to student needs. The overall improvement in student block scores across the IM and WM courses was from -1.19 to .03--again in excess of one standard deviation.

No evaluation data were available on PME students as all of the instructors who volunteered to participate in the program were from parts of the course which, at the time, were not implemented in a CMI mode.

Phase II evaluation. Given that the study skill materials were transitioned to the individual schools after the first phase of the evaluation, the data from the second phase resulted primarily from anecdotal instructor comments. In the WM course, this anecodotal information indicated that students assigned study skill remediation by the computer before beginning their military training were performing exceptionally well in the WM course. To determine the validity of this claim, an analysis was designed to compare trainees receiving this remediation with a matched group of trainees who were enrolled in the course during an earlier time period and who had not received the Study Skill Modules. Although the two groups were matched on the basis of their low reading scores, control group students were found to have higher mean scores on three additional reading variables and to have lower test and state anxiety scores as compared with students in the experimental group. An analysis of covariance, using reading and test and state anxiety scores as covariates, was calculated to determine if the two groups differed significantly on selected time and score variables. The covariance results were mixed, showing somewhat of an advantage for students receiving study skill training for the lesson score dependent variable on the 18 lessons which were common between the two time periods.

Upon further discussions with instructors in the WM course, it was learned that (a) fewer students were being disenrolled from the course due to academic failure since the study skills program went into effect, and (b) students succeeding in the course following study skills remediation were students who would

have failed in the course prior to the implementation of this program. Some support for this anecdotal information was found by comparing disenrollment rates between the time period after the study skill materials were implemented and a time period before these materials were implemented. This comparison indicated that academic disenrollments dropped by over one third from the no training to the training periods.

In PME a similar situation occurred. Anecdotal information from instructors indicated that after the mandatory study skills remediation program was implemented, trainees were performing better than before the program was implemented and failure rates were reduced. As analysis similar to that conducted in the WM course was designed to investigate this claim. Trainees who participated in this program were matched with trainees who were enrolled in the course during an earlier time period and who had not received the study skill materials. Data on time-to-complete and test scores for selected course blocks were analyzed in a one-way analysis of variance for the two groups. Results of this analysis indicated that while none of the differences in block times or scores were significant, the trainees in the experimental group (students receiving the study skills training) were spending less time to complete the course and were achieving higher block test scores than their counterparts in the control group (students not receiving study skills training).

Discussion and Conclusions

Although the data from the Phase I evaluation are limited with respect to number of samples, the findings of dramatic student improvement in block times and scores following study skills remediation are so consistent as to warrant the conclusion that this training met the goal of increasing student efficiency and effectiveness in a CMI training environment. Similarly, anecdotal information in the Phase II evaluation indicated (a) improved student performance and reduced student failures and disenrollments following implementation of computer-assigned study skills remediation, and (b) consistent instructor acceptance of the study skills materials. This package can accordingly, be said to have achieved its goal of leading to practical benefits. In addition, the time spent on the study skills remediation (one to two hours per module) can be said to be cost-effective in terms of the improvements yielded in student performance.

Two major implications of the study skills training results are that this relatively short training (a) continues to show its effect in improved student performance throughout the course, and (b) tends to have its most dramatic effect on the performance of students who are assigned all four of the study skill modules. The first of these phenomena would be expected on the basis of the strategies used to modify student study behaviors, i.e., active information processing strategies and cognitive self-control strategies.

Since emphasis is placed on active and meaningful information processing, the continuing practice itself, and its immediate resultant reinforcement, would tend to maintain and strengthen the desired behaviors over time. Similarly, it would be expected that the cognitive self-control strategies, such as the positive self-talk scenarios used in the Concentration Management and Test Taking modules, would become habitual with practice.

The finding in Phase I that students assigned all four Study Skills Modules tended to improve their performance to a greater extent than students receiving only one module (particularly if the one module was Reading Comprehension) may well have been due to the sheer mass of the study skills training. It could also be attributable, however, to inappropriate instructor matches of learning materials with student needs or the characteristics of the particular students selected for study skills remediation. It may be that the students selected had other aptitude or motivational characteristics that differentially moderated the effects of the study skills training. This suggests that an individualized assignment procedure which used student characteristic data in assisting instructors' diagnoses would further improve the effectiveness of study skills training.

In assessing the overall effects of this study, it seems clear that there are numerous advantages to beginning a remediation program, such as the present one, with instructional personnel involvement. Introducing new, contractor developed materials and procedures into an ongoing, operational environment is rarely met with positive affect by course instructors. Given this situation, including these personnel in the implementation and evaluation strategy; informing them as to the why, what, when, where, and how of the training materials; and showing them how the training materials can improve or enhance their role in the instructional environment, can diffuse a major portion of this negativism. After understanding the present study and the nature of the study skills program, WM and PME instructional personnel saw its value and adopted it as their own program. This understanding had to be experienced--it could not be taught. Having acquired the understanding of the study skills package and then being part of the initial evaluation, these personnel were then comfortable in giving up their personal control over the diagnosis and remediation of study skills problems. They were content to give the computer responsibility for its implementation. They recognized that the computer could perform these simple diagnosis and remediation activities as well as, if not more efficiently and consistently than many instructors, and that the computer should be given these responsibilities in an operational study skills program. Failing to include instructional personnel in a research program and restricting them from making their own implementation decisions, however, can prevent such a successful transition. It would seem, therefore, that for those involved in operational research in computer-based environments, careful attention to user involvement with the products and implementation decisions can help in the acceptance of <u>both</u> the products and the computer-based technology.

Perhaps the most significant aspect of this study, then, was the fact that two of the three schools which participated in the first phase of the evaluation perceived the Study Skill Modules to be useful to their particular environment and accordingly, adopted them as mandatory aspects of their curriculum. Given that the products of many successful research studies do not realize such a transition, the Study Skill Modules could be judged successful on this basis alone. Furthermore, these materials were transitioned in the Spring of 1978 and, as of December 1979, both PME and WM are still using the materials and still recommending their use to other schools and services. For example, based on recommendations from course instructors involved in the present project, copies of these materials have been requested by and sent to (a) the Armed Forces Air Intelligence Training Center; (b) the Air Force Faculty Development Division at Lowry AFB; (c) the Air Force Technology Application Officer at Sheppard AFB; (d) the Air Force Academy (for use in its How to Study program); (e) the Navy AFUN (AP) Training Division; (f) the Navy AVA(AI) Training Division; (g) the Navy BE/E school at Millington and at Great Lakes; (h) the Navy PE school at Great Lakes; (i) the Navy Mechanical Training Dept.; (j) the Naval Air Technical Training Command at Millington; and (k) the Marine Corps BE/E Training Division. Most encouraging is the fact that the Air Force Training Evaluation Division at Lowry AFB is currently investigating the possibility of implementing these study skills materials in an ongoing orientation program which all trainees are required to attend upon arrival at Lowry AFB and before beginning their military training.

Educational Importance of the Study

The present study indicates that providing students with specific study skills remediation which capitalize on their active information processing strategies and/or provides them with methods for controlling dysfunctional behavior is highly feasible and promises to be cost-effective in terms of improved training effectiveness and efficiency.

Reference Notes

1. Poore, R. P., Jr., & Pappas, J. P. A criterion related validity study of the McGraw-Hill Inventory of Study Habits and Attitudes. Paper presented at the annual meeting of the Rocky Mountain Psychological Association, Denver, May 1974.

2. Weinstein, C. E. Learning of elaboration strategies. Unpublished doctoral dissertation, University of Texas at Austin, 1975.

3. Weinstein, C. E. Development and evaluation of training program to teach generalizable elaboration skills. Research Proposal Submitted to Defense Advanced Research Projects Agency, University of Texas at Austin, January 1976.

4. Weinstein, C. E. Cognitive elaboration learning strategies. Paper presented at the Annual Meeting of the American Educational Research Association, New York, March 1977.

5. Woodley, K. K. Test-Wiseness Program development and evaluation, Paper presented at the annual meeting of the American Educational Research Association, New Orleans, March 1973.

6. Dobrovolny, J. L., McCombs, B. L., & Judd, W. A. Study Skills Package: Development and Evaluation. AFHRL-TR-79-43. Lowry AFB, CO; Technical Training Division, Air Force Human Resources Laboratory, in press.

7. Dobrovolny, J. L., McCombs, B. L., & Judd, W. A. Transitioning instructor roles in computer-based environments: A preliminary program for improving instructor attitudes. Paper presented at the Annual Meeting of the National Educational Computing Conference, June, 1979.

8. McCombs, B. L., & Dobrovolny, J. L. The Study Skills Questionnaire: Preliminary validation of a measure for assessing students' perceived areas of study skills weakness. Paper presented at the Annual Meeting of the American Educational Research Association, Boston, April, 1979.

References

Anderson, R.C., Goldberg, S. R., & Hidde, J. L. Meaningful processing of sentences. Journal of Educational Psychology, 1971, 62, 395-399.

Andre, T. A., & Sola, J. Imagery, verbatim and paraphrased questions, and retention of meaningful sentences. Journal of Educational Psychology, 1976, 68(6), 661-669.

Arkes, H. R., Schumacher, G. M., & Gardner, E. T. Effects of orienting tasks on the retention of prose material. Journal of Educational Psychology, 1976, 68(5), 536-545.

Bellezza, F. S., Cheesman, F. L., & Reddy, B. G. Organization and semantic elaboration in free recall. Journal of Experimental Psychology: Human Learning and Memory, 1977, 3(5), 539-550.

Bernstein, S. L. The effects of children's question-asking behavior on problem solution and comprehension of written material. Dissertation Abstracts International, 1973, 34, 3129A-3130A.

Bobrow, S. A., & Bower, G. H. Comprehension and recall of sentences. Journal of Experimental Psychology, 1969, 80, 455-461.

Briggs, R. D., Tosi, D. J., & Morley, R. M. Study habit modification and its effect on academic performance: A behavioral approach. Journal of Educational Research, 1971, 64(8), 347-350.

Carter, J. F., & Van Matre, N. H. Note taking versus note having. Journal of Educational Psychology, 1975, 67(6), 900-904.

Dansereau, D. F. The development of the learning strategy curriculum. In H. F. O'Neil, Jr. (Ed.), Cognitive and Affective Learning Strategies. New York: Academic Press, 1979.

Dansereau, D. F., Actkinson, T. R., Long, G. L., & McDonald, B. Learning strategies: A review and synthesis of the current literature. AFHRL-TR-74-70, AD-A007722, Lowry AFB, CO: Technical Training Division, Air Force Human Resources Laboratory, December 1974.

Dansereau, D. F., Collins, K. W., McDonald, B. A., Diekhoff, G. M., Garland, J. C., Holley, C. S., Evans, S. H., Irons, D., Long, G. et al, The further development of a systematic training program for enhancing learning strategies and skills. Yearly Technical Report 0002AB, Advanced Research Projects Agency, May 1977.

Dansereau, D. F., Long, G. L., McDonald, B. A., & Actkinson, T. R. Learning strategy inventory development and assessment. AFHRL-TR-75-40, AD-A014 721. Lowry AFB, CO: Technical Training Division, Human Resources Laboratory, June 1975.

Dansereau, D. F., Long, G. L., McDonald, B. A., Actkinson, T. R., Collins, K. W., Evans, S. H., Ellis, A. M., & Williams, S. Learning strategy training program: Paraphrasing strategy for effective learning. AFHRL-TR-75-46, AD-A014 723. Lowry AFB, CO: Technical Training Division, Air Force Human Resources Laboratory, June 1975.

Dansereau, D. F., Long, G. L., McDonald, B. A., Actkinson, T. R., Ellis, A. M., Collins, K., Williams, S., & Evans, S. H. Effective learning strategy training program: Development and assessment, AFHRL-TR-75-41, AB-A014 722. Lowry AFB, CO: Technical Training Division, Air Force Human Resources Laboratory, June 1975.

Delaney, H. D. Interaction of individual differences with visual and verbal elaboration instructions. Journal of Educational Psychology, 1978, 70(3), 306-318.

Doctorow, M., Wittrock, M. C., & Marks, C. Gnerative processes in reading comprehension. Journal of Educational Psychology, 1978, 70(2), 109-118.

Faw, H. W., & Waller, T. G. Mathemagenic behaviors and efficiency in learning from prose materials: Review, critique and recommendations. Review of Educational Research, 1976, 46(4), 691-720.

Fisher, J. L., & Harris, M. B. Effect of note taking and review on recall. Journal of Educational Psychology, 1973, 65(3), 321-325.

Frase, L. T., & Schwartz, B. J. Effect of question production and answering on prose recall. Journal of Educational Psychology, 1975, 67(5), 628-635.

Gadzella, B. M., Goldston, J. T., & Zimmerman, M. L. Effectiveness of exposure to study techniques on college students' perceptions. Journal of Educational Research, 1977, 71(1), 26-30.

Gehlbach, R. D. Individual differences: Implications for instructional theory, research, and innovation. Educational Researcher, 1979, 8(4), 8-14.

Glaser, R. Trends and research questions in psychological research on learning and schooling. Educational Researcher, 1979, 8(10), 6-13.

Glass, G. V. Policy for the unpredictable (uncertainty research and policy). Educational Researcher, 1979, 8(9), 12-14.

Gross, L. J. The effects of test-wiseness on standardized test performance. Scandinavian Journal of Educational Research, 1977, 21(2), 97-11.

Groveman, A. M., Richards, C. S., & Caple, R. B. Effects of study-skills counseling versus behavioral self-control techniques in the treatment of academic performance. Psychological Reports, 1977, 41(1), 186.

Hunter, I. M. Imagery, comprehension, and mneumonics. Journal of Mental Imagery, 1977, 1(1), 65-72.

Kerlinger, F. N. The influence of research on education practice. Educational Researcher, 1977, 6(8), 5-12.

Larkin, J. H., & Reif, F. Analysis and teaching of a general skill for studying scientific text. Journal of Educational Psychology, 1976, 68(4), 431-440.

Lyon, D. R. Individual differences in immediate serial recall: A matter of mneumonics? Cognitive Psychology, 1977, 9(4), 403-411.

McCauley, C., Kellas, G., Dugas, J., & DeVellis, R. F. Effects of serial rehearsal training on memory search. Journal of Educational Psychology, 1976, 68(4), 474-481.

McReynolds, W. T., & Church, A. Self-control, study skills development and counseling approaches to the improvement of study behavior. Behavior Research and Therapy, 1973, 11, 233-235.

Meichenbaum, D. Enhancing creativity by modifying what subjects say to themselves. American Educational Research Journal, 1975, 12(2), 129-145.

Mistler-Lachman, J. L. Depth comprehension and sentence memory. Journal of Verbal Learning and Verbal Behavior, 1974, 13, 98-103.

Olshavsky, J. E. Reading as problem solving: An investigation of strategies. Reading Research Quarterly, 1976-77, 12(4), 654-674.

Postman, L., & Kruesi, E. The influence of orienting tasks on encoding and recall of words. Journal of Verbal Learning and Verbal Behavior, 1977, 16(3), 353-369.

Rasco, R. W., Tennyson, R. D., & Boutwell, R. C. Imagery instructions and drawings in learning prose. Journal of Educational Psychology, 1975, 67(2), 188-192.

Rickards, J. P., & August, G. J. Generative underlining strategies in prose recall. Journal of Educational Psychology, 1975, 67(6), 860-865.

Rogers, T. B. Self-reference in memory: Recognition of personality items. Journal of Research in Personality, 1977, 11(3), 295-305.

Shimmerlik, S. M. Organization theory and memory for prose: A review of the literature. Review of Educational Research, 1978, 48(1), 103-120.

Shimmerlik, S. M., & Nolan, J. D. Reorganization and the recall of prose. Journal of Educational Psychology, 1976, 68(6), 779-786.

Snowman, J. & Cunningham, D. J. A comparison of pictorial and written adjunct aids in learning from text. Journal of Educational Psychology, 1975, 67(2), 307-311.

Wittrock, M. C. Learning as a generative process. Educational Psychologist, 1974, 11(2), 87-95.

Wittrock, M. C., & Lumsdaine, A. A. Instructional psychology. Annual Review of Psychology, 1977, pp. 417-459.

TABLE 1

Standardized Pre/Post Study Skills Remediation
Block Times and Scores for IM and WM Students

Course/ Student	Pre-Treatment Score	Post-Treatment Score	Modules Taken[a]
Block Time			
IM-1	1.77	1.57	RC, M, CM
IM-2	1.94	.09	RC, M, CM
IM-3	2.75	.89	RC
IM-4	5.45	2.00	RC, M, TT, CM
IM-5	2.40	1.96	TT
IM Average	2.86	1.30	
WM-1	2.48	-.84	RC, M, TT, CM
WM-2	2.34	1.40	RC, M, TT, CM
WM-3	1.89	1.22	RC, M, TT, CM
WM-4	4.51	2.60	RC, M, TT, CM
WM-5	.71	1.42	RC
WM-6	1.30	1.63	RC
WM Average	2.21	1.24	
Overall Average	2.54	1.27	
Block Score			
IM-1	-1.12	-.13	RC, M, CM
IM-2	-1.14	-.59	RC, M, CM
IM-3	-1.88	-.93	RC
IM-4	-2.24	-.29	RC, M, TT, CM
IM-5	-.89	.25	TT
IM Average	-1.45	-.34	
[b] WM-1			
WM-2	-1.82	.95	RC, M, TT, CM
WM-3	- .11	.30	RC, M, TT, CM
WM-4	-2.43	-.32	RC, M, TT, CM
WM-5	- .20	.51	RC
WM-6	- .10	.61	RC
WM Average	- .93	.41	
Overall Average	-1.19	.03	

[a] RC = Reading Comprehension; M
CM = Concentration Management

[b] No Pre/Post Score Data Available